REMARKS

This paper is being provided in response to the Office Action mailed January 29, 2004, for the above-referenced application. In this response, Applicants have amended claims 1 and 8 and have added new claims 16-18 to clarify that which Applicants consider to be the invention. Applicants respectfully submit that the amendments to the claims and the new claims are fully supported by the originally-filed specification.

Applicants thank the Examiner for the interview accorded on November 12, 2003, with Applicants' representative in which the Examiner agreed to reissue the present Office Action with a new mailing date in order to identify U.S. Patent No. 5,355,044 on the notice of references cited.

The rejection of claims 1, 2, 4, 8-11 and 13 under 35 U.S.C. 103(a) as being unpatentable over JP 11-146616 to Suzuki et al. (hereinafter "Suzuki") in view of U.S. Patent No. 5,355,044 to Uchida et al. (hereinafter "Uchida") is hereby traversed and reconsideration is respectfully requested in view of the amendments to the claims contained herein.

Independent claim 1, as amended herein, recites a DC motor. A rotor unit is rotatably arranged within the motor and includes a cylindrical field magnet having a single structure with a rotating shaft press fit at the center. The cylindrical field magnet is magnetized such that S and N poles alternate in a circumferential direction. A stator unit is arranged circumferentially around the rotor made of a plurality of stator yokes. The yokes are made of a large number of circumferentially-stacked thin plates, each of which is a salient pole, and to which is attached a

plurality of coil units made by winding a magnetic wire on a bobbin. Each of the S and N poles has a plurality of stage in the axial direction, and are circumferentially shifted from each other by a predetermined shift amount. Claims 2-7 depend on independent claim 1.

Independent claim 8, as amended herein, recites a DC motor. A rotor unit is rotatably arranged within the motor and includes a cylindrical field magnet having a single structure and fixed to holder means in which a rotating shaft is press-fitted at a center thereof. The cylindrical field magnet is magnetized such that S and N poles alternate in a circumferential direction thereof. A stator unit is circumferentially arranged around the rotor unit and includes a plurality of stator yokes so arranged as to oppose the cylindrical field magnet. Each of the stator yokes includes a large number of circumferentially-stacked thin plates each of which constitutes a salient pole, and a plurality of coil units. Each of the S and N poles has a plurality of stages in an axial direction and shifted from each other in the circumferential direction of the cylindrical field magnet with a predetermined shift amount. Claims 8-15 depend on independent claim 8.

The Suzuki reference discloses a cylindrical motor structure including a rotor unit with a cylindrical rotor magnet 13. The rotor unit includes a salient pole 23 and a winding part formed by adjusting its dimension in an axial direction and layered in the circumferential direction. An armature is arranged by inserting a coil 12 whose magnet wire is wound around the winding part of the salient pole and press-fitted to a stator 20. (See Abstract, Figures 1, 2 of Suzuki.)

The Uchida reference discloses a rotor structure of an electric synchronous motor. The Office Action cites Uchida as disclosing that each block of a rotor has a plurality of magnets that are offset from one another around the axis of the rotor.

Applicants' independent claims, as amended herein, recite that a rotor unit of a DC motor includes *a cylindrical field magnet having a single structure fixed to a holder to which a rotating shaft is coupled, said cylindrical field magnet being magnetized such that S and N poles alternate with each other in a circumferential direction thereof* and *wherein each of the S and N poles has a plurality of stages formed in an axial direction and shifted from each other in the circumferential direction of said field magnet with a predetermined shift amount.* Applicants have found that a DC motor having a single structure cylindrical field magnet as recited provides for a simplified structure in which cogging is reduced and vibration is decreased while the performance such as torque is maintained. (See, for example, page 4, lines 15-24 and Figures 3A-3C of the present application.)

Applicants respectfully submit that neither Suzuki nor Uchida, taken alone or in combination, teach or fairly suggest at least the above-noted features as claimed by Applicants. As noted in the Office Action, Suzuki does not disclose that each of S and N poles has a plurality of stages formed in an axial direction and shifted from each other in a circumferential direction with a predetermined shift amount as claimed by Applicants. Further, Uchida does not disclose a rotor unit including a cylindrical field magnet having a single structure magnetized as claimed by Applicants. Uchida discloses that four separate rotor elements 101, 102, 103 and 104 are arranged to be at four stages from the left to the right in a longitudinal direction of the rotor.

(See col. 2, lines 27-29 of Uchida.) Applicants submit that for separated rotor magnet elements as disclosed by Uchida, it will arguably be harder to accurately shift the S and N poles because same poles are repelled from each other at the edge portion of the separated rotor elements. In contrast, in the present invention, it is easier to accurately shift the S and N poles, because the cylindrical field magnet has a single structure.

Moreover, in addition to the foregoing structural differences between the present claimed invention and the cited references, the aims of the present claimed invention and the devices of the cited references are different. Namely, it is an aim of the present invention to reduce a cogging torque. On the other hand, Uchida's aim is to reduce or cancel a plurality of cyclic torque ripple components from an output torque of the motor.

Accordingly, Applicants respectfully submit that neither Suzuki nor Uchida, taken alone or in combination, teach or fairly suggest at least the features of a rotor unit of a DC motor that includes *a cylindrical field magnet having a single structure fixed to a holder to which a rotating shaft is coupled, said cylindrical field magnet being magnetized such that S and N poles alternate with each other in a circumferential direction thereof* and *wherein each of the S and N poles has a plurality of stages formed in an axial direction and shifted from each other in the circumferential direction of said field magnet with a predetermined shift amount*, as is claimed by Applicants. In view of the above, Applicants respectfully request that this rejection be reconsidered and withdrawn.

The rejection of claims 3 and 12 under 35 U.S.C. 103(a) as being unpatentable over Suzuki in view of Uchida and further in view of U.S. Patent No. 5,034,642 to Hoemann et al. (hereinafter "Hoemann") is hereby traversed and reconsideration is respectfully requested in view of the amendments to the claims contained herein.

The features of independent claims 1 and 8 are discussed above with respect to the Suzuki and Uchida references. Claims 3 and 12 depend thereon.

The Hoemann reference discloses a permanent magnet rotor and motor. The Office Action cites Hoemann as disclosing that a rotor position detection element is adjusted by one-half the shift amount of respective stages.

Applicants respectfully submit that Hoemann fails to overcome the above-noted deficiencies of the Suzuki and Uchida references with respect to Applicant's present claimed invention. Applicants respectfully submit that neither Suzuki, Uchida nor Hoemann, taken alone or in any combination, teach or fairly suggest at least the features of a rotor unit of a DC motor that includes *a cylindrical field magnet having a single structure fixed to a holder to which a rotating shaft is coupled, said cylindrical field magnet being magnetized such that S and N poles alternate with each other in a circumferential direction thereof* and *wherein each of the S and N poles has a plurality of stages formed in an axial direction and shifted from each other in the circumferential direction of said field magnet with a predetermined shift amount*, as is claimed by Applicants. Accordingly, Applicants respectfully request that this rejection be reconsidered and withdrawn.

The rejection of claims 5, 7, 14 and 15 under 35 U.S.C. 103(a) as being unpatentable over Suzuki in view of Uchida and further in view of U.S. Patent No. 5,717,268 to Carrier et al. (hereinafter "Carrier") is hereby traversed and reconsideration is respectfully requested in view of the amendments to the claims contained herein.

The features of claims 1 and 8 are discussed above with respect to Suzuki and Uchida. Claims 5, 7, 14 and 15 depend thereon.

The Carrier reference discloses an electric motor with a tachometer signal generator. The Office Action cites Carrier as disclosing a DC brushless motor with an eight poles outer rotor and a six poles stator unit.

Applicants respectfully submit that Carrier fails to overcome the above-noted deficiencies of the Suzuki and Uchida references with respect to Applicant's present claimed invention. Applicants respectfully submit that neither Suzuki, Uchida nor Carrier, taken alone or in any combination, teach or fairly suggest at least the features of a rotor unit of a DC motor that includes *a cylindrical field magnet having a single structure fixed to a holder to which a rotating shaft is coupled, said cylindrical field magnet being magnetized such that S and N poles alternate with each other in a circumferential direction thereof* and *wherein each of the S and N poles has a plurality of stages formed in an axial direction and shifted from each other in the circumferential direction of said field magnet with a predetermined shift amount*, as is claimed

by Applicants. Accordingly, Applicants respectfully request that this rejection be reconsidered and withdrawn.

The rejection of claim 6 under 35 U.S.C. 103(a) as being unpatentable over Suzuki in view of Uchida and further in view of U.S. Patent No. 4,998,032 to Burgbacher et al. (hereinafter "Burgbacher") is hereby traversed and reconsideration is respectfully requested in view of the amendments to the claims contained herein.

The features of claim 1 are discussed above with respect to Suzuki and Uchida. Claim 6 depends thereon.

The Burgbacher reference discloses a permanent magnet excited electric motor. The Office Action cites Burgbacher as disclosing a DC brushless motor with an eight poles inner rotor and a six poles stator unit.

Applicants respectfully submit that Burgbacher fails to overcome the above-noted deficiencies of the Suzuki and Uchida references with respect to Applicant's present claimed invention. Applicants respectfully submit that neither Suzuki, Uchida nor Burgbacher, taken alone or in any combination, teach or fairly suggest at least the features of a rotor unit of a DC motor that includes *a cylindrical field magnet having a single structure fixed to a holder to which a rotating shaft is coupled, said cylindrical field magnet being magnetized such that S and N poles alternate with each other in a circumferential direction thereof* and *wherein each of the S and N poles has a plurality of stages formed in an axial direction and shifted from each other in*

the circumferential direction of said field magnet with a predetermined shift amount, as is claimed by Applicants. Accordingly, Applicants respectfully request that this rejection be reconsidered and withdrawn.

Further, Applicants have added new claims 16-18 and respectfully submit that these claims are patentable over the prior art of record.

Based on the above, Applicants respectfully request that the Examiner reconsider and withdraw all outstanding rejections and objections. Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-248-4038.

Respectfully submitted,
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